

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Algebra 2 CC: Imaginary Numbers

**DEFINITION**

A number of the form  $a\sqrt{-1} = ai$  is a **pure imaginary number** where  $a$  is a non-zero real number.

$$i = \sqrt{-1}$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1i = -i$$

$$i^4 = i^2 \cdot i^2 = -1(-1) = 1$$

**DEFINITION**

A **complex number** is a number of the form

$$a + bi$$

where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ .

## Developing Skills

In 3–18, write each number in terms of  $i$ .

- |                     |                              |                       |                       |
|---------------------|------------------------------|-----------------------|-----------------------|
| 3. $\sqrt{-4}$      | 4. $\sqrt{-81}$              | 5. $\sqrt{-9}$        | 6. $-\sqrt{-36}$      |
| 7. $-\sqrt{-121}$   | 8. $\sqrt{-8}$               | 9. $\sqrt{-12}$       | 10. $-\sqrt{-72}$     |
| 11. $5\sqrt{-27}$   | 12. $-\frac{1}{2}\sqrt{-80}$ | 13. $-\sqrt{-51}$     | 14. $\sqrt{-500}$     |
| 15. $5 + \sqrt{-5}$ | 16. $1 + \sqrt{-3}$          | 17. $-4 - \sqrt{-24}$ | 18. $-3 + 2\sqrt{-9}$ |

In 19–34, write each sum or difference in terms of  $i$ .

- |   |   |
|---|---|
| 19. $\sqrt{-100} + \sqrt{-81}$  | 20. $\sqrt{-25} - \sqrt{-4}$  |
| 21. $\sqrt{-144} + \sqrt{-1}$   | 22. $\sqrt{-49} - \sqrt{-16}$   |
| 23. $\sqrt{-12} + \sqrt{-27} - \sqrt{-75}$                                    | 24. $2\sqrt{-5} + \sqrt{-125}$  |
| 25. $\sqrt{4} + \sqrt{-4} + \sqrt{-36} - \sqrt{36}$                           | 26. $\sqrt{50} + \sqrt{-2} + \sqrt{200} + \sqrt{-50}$                       |
| 27. $\sqrt{4} + \sqrt{-32} + \sqrt{-8}$                                       | 28. $3 + \sqrt{-28} - 7 - \sqrt{-7}$  |
| 29. $-3 - \sqrt{-10} + 2 - \sqrt{-90}$  | 30. $-2 + \sqrt{-16} + 7 - \sqrt{-49}$                                      |
| 31. $3 + \sqrt{-36} - 6 + \sqrt{-1}$  | 32. $\frac{1}{7} + \sqrt{-\frac{1}{8}} + \frac{2}{7} - \sqrt{-\frac{1}{2}}$ |
| 33. $-\frac{1}{2} + \sqrt{-\frac{2}{3}} - \frac{1}{2} + \sqrt{-\frac{24}{9}}$ | 34. $\sqrt{0.2025} + \sqrt{-0.09}$  |

In 35–43, write each number in simplest form.

- |                          |                           |                               |
|--------------------------|---------------------------|-------------------------------|
| 35. $3i + 2i^3$          | 36. $5i^2 + 2i^4$         | 37. $i - 5i^3$                |
| 38. $2i^5 + 7i^7$        | 39. $i + i^3 + i^5$       | 40. $4i + 5i^8 + 6i^3 + 2i^4$ |
| 41. $i^2 + i^{12} + i^8$ | 42. $i + i^2 + i^3 + i^4$ | 43. $i^{57}$                  |